CONTROL FOR WATERCRAFT PROPULSION SYSTEM

CLAIMS FOR INTERVIEW

1. A watercraft comprising a hull, an engine supported by the hull, a propulsion request device configured to allow an operator to input a propulsion request, a propulsion device supported by the hull and being driven by the engine, an engine speed sensor configured to detect an actual speed of the engine, a controller configured to communicate with the propulsion request device and to affect a power output of the engine based on an output of the propulsion request device and a speed of the engine, the controller being configured to determine an actual engine speed value of the engine based on the output of the engine speed sensor and a modified engine speed value, based on the output of the engine speed sensor, and the modified engine speed value being configured to change more slowly than the actual speed of the engine the controller being further configured to maintain the power output of the engine at magnitudes above a magnitude of power output corresponding the output of the propulsion request device, until the modified engine speed falls below a predetermined value.

2. The watercraft according to Claim 1, wherein the controller is also configured to change a power output of the engine based on the modified engine speed value.

3. The watercraft according to Claim 1, wherein the modified engine speed value is configured to be more in proportion to a speed of the watercraft, than the actual engine speed, when the watercraft is operating in a body of water.

4. The watercraft according to Claim 1, wherein the controller is configured to determine the modified engine speed by averaging engine speeds detected by the engine speed sensor.

5. The watercraft according to Claim 4, wherein the controller is configured to average actual engine speeds using a simple moving average method.

6. The watercraft according to Claim 4, wherein the controller is configured to average actual engine speeds using a weighted moving average method.

7. The watercraft according to Claim 4, wherein the controller is configured to average actual engine speeds using an exponential moving average method.

8. The watercraft according to Claim 1 additionally comprising a steering mechanism configured to allow an operator to change a direction of travel of the watercraft, a steering mechanism sensor connected to the controller and configured to

detect the position of the steering mechanism, wherein the controller is configured to slow the engine speed at a first rate that is slower van in uncontrolled speed reduction rate of the engine when the propulsion request device outputs a minimum propulsion request and the steering mechanism is not moved to the position indicating that the operator intends to change the direction of travel the watercraft, and to slow the engine speed at a second rate that is slower than the first rate when the steering mechanism is moved to a position indicating that the operator intends to change the direction of travel the watercraft.

9. The watercraft according to Claim 1 additionally comprising a throttle valve, a spring configured to bias the throttle valve toward a closed position, and an actuator configured to slow the closing the closing of the throttle valve based on the modified engine speed value.

10. A method of controlling an engine of a watercraft comprising detecting a propulsion request from an operator of the watercraft, detecting an actual speed of the engine, controlling a power output of the engine based on the detected actual speed of the engine and based on the propulsion request, determining a modified engine speed value such that the modified engine speed value changes more slowly than the detected engine speed.

11. The method according to Claim 10 additionally comprising detecting a steering angle of the watercraft, and operating the engine at a power output level greater than that corresponding to the propulsion request if the steering angle indicates that an operator of the watercraft intends to change the direction of travel of the watercraft.

12. The method according to Claim 10 additionally comprising determining if the propulsion request has changed abruptly from an elevated value to a minimum value, determining if an operator of the watercraft intends to change the direction of travel o the watercraft, lowering the engine speed at a rate less than that corresponding to the abrupt change of the propulsion request if the operator does not intend to change the direction of travel of the watercraft, and lowering the speed of the engine at a second rate, less than the first rate, if the operator does intend to change the direction of travel of the watercraft.

13. The method according to Claim 12 wherein determining a modified engine speed value comprises modifying the actual engine speed such that the modified engine speed value is more in proportion, than the detected actual engine speed, to a speed of the watercraft when operating normally on a body of water.

14. The method according to Claim 10 additionally comprising limiting the speed of the engine to a maximum engine speed, determining a ratio of the actual engine speed to the modified engine speed, and lowering the maximum engine speed if the ratio is larger than a predetermined value.

15. A watercraft comprising a hull, an engine supported by the hull, a propulsion request device configured to allow an operator to input a propulsion request and configured to emit a propulsion request output, a controller configured to determine if the propulsion request output changes abruptly from a first value to a second lower value, the controller being configured to lower the engine speed at a first rate slower than a rate at which the propulsion request output abruptly changed, the watercraft also including a steering mechanism, and a steering sensor connected to the controller, the controller being further configured to lower the engine speed at a second rate that is lower than the first rate.

16. The watercraft according to Claim 15 additionally comprising a throttle valve biased toward a closed position with a spring configured to close the throttle valve at an uncontrolled speed, the first and second rates being slower than the uncontrolled speed.

17. The watercraft according to Claim 16 additionally comprising an air bypass system configured to guide through a bypass passage around the throttle valve and a bypass valve disposed in the bypass passage configured to meter an amount of air flowing through the bypass passage, the controller being configured to control the bypass valve so as to lower the engine speed at the first and second rates.

18. A watercraft comprising a hull, an engine supported by the hull, a propulsion input device configured to allow an operator to direct a propulsion request to the engine, a propulsion device supported by the hull and being driven by the engine, a controller configured to affect a power output of the engine, a sensor configured to detect a speed of the engine, a steering mechanism configured to allow an operator of the watercraft to change a direction of travel of the watercraft, a sensor configured to detect a position of the steering mechanism, the controller being configured to increase a power output of the engine to an elevated power output level that is beyond a power output corresponding to the output of the propulsion request input device if the steering mechanism is moved to a position indicating an operator's desire to change a direction of travel of the watercraft, the controller also being configured to terminate the increase in power output after a delay after the engine speed falls below a predetermined engine speed.

19. The watercraft according to Claim 18, wherein the controller is configured to generate the delay based on a mathematical operation on the detected engine speed.

20. The watercraft according to Claim 18, wherein the controller is configured to generate the delay based on a moving average of the detected engine speed.

21. The watercraft according to Claim 18, wherein the position indicating the operators desire to change a direction of travel of the watercraft corresponds to an angular position of the steering mechanism beyond a predetermined angular position.

22. A method of providing additional steering force for a watercraft comprising detecting a propulsion request from an operator of the watercraft, detecting a steering direction request from the operator of the watercraft, detecting a speed of an engine of the watercraft, increasing a power output of the engine to an elevated power output level that is greater than the power output level corresponding to the propulsion request, returning the power output of the engine to the level corresponding to the propulsion request after a delay after the engine speed falls below a predetermined engine speed value.

23. The method according to Claim 22, wherein returning the power output comprises calculating an average engine speed and returning the power output of the engine to the level corresponding to the propulsion request after the average engine speed falls below a predetermined average engine speed.

24. The method according to Claim 23, wherein calculating an average engine speed comprises calculating a moving average of the engine speed.

25. The method according to Claim 23, wherein calculating an average engine speed comprises calculating a weighted moving average engine speed.

26. The method according to Claim 23, wherein calculating an average engine speed comprises calculating an exponential moving average of the engine speed.